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(54) A Display System and a Method of Displaying Information

(57) A display system and method for displaying information are provided which is especially useful in a portable computer with a display screen 17 too small to display all of a document data file from memory in readable form at once. The whole document can be displayed as a set of non-readable horizontal lines (i.e. showing the layout) at 51 and a cursor 53 can be used to select a portion of the document for normal-size (readable) display.

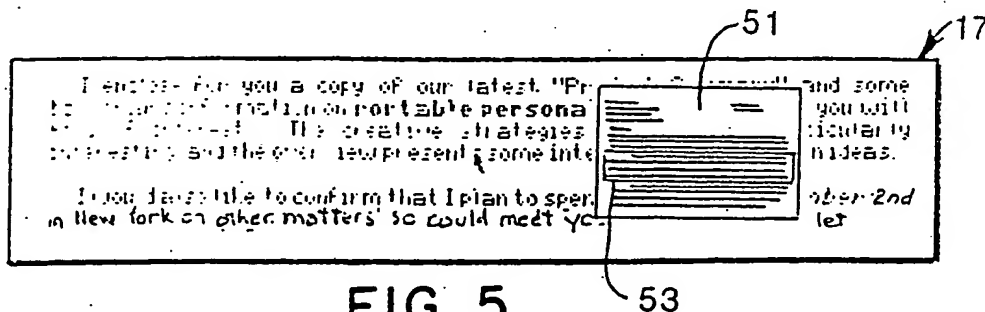


FIG. 5

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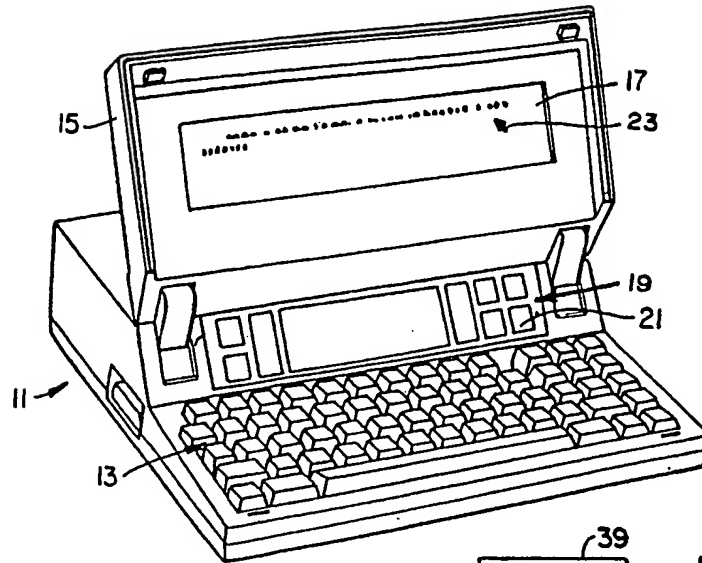


FIG. 1.

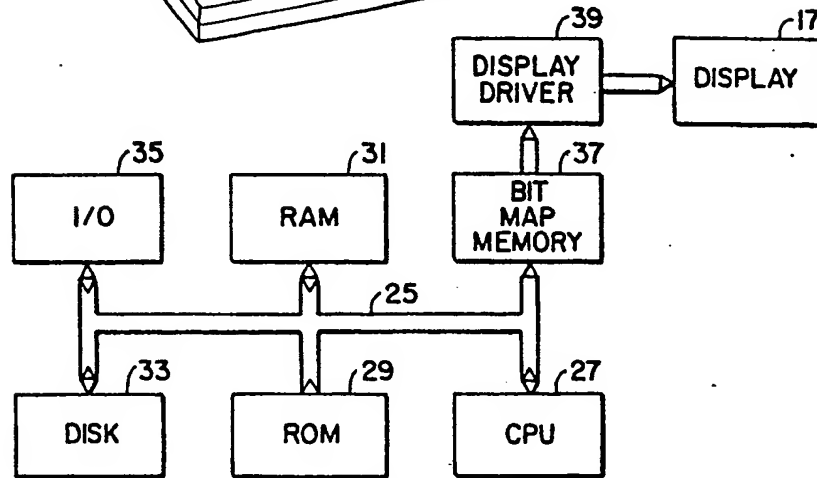


FIG. 2.

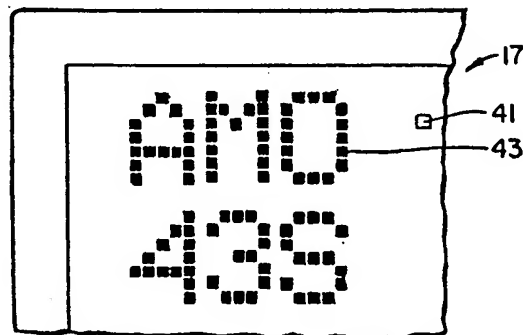


FIG. 3A.

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0
0	0	0	1	0	1	0	0	1	1	0	1	1	0	1	0	0	0	1	0
0	0	1	0	0	0	1	0	1	0	1	0	1	0	1	0	0	0	1	0

FIG. 3B.

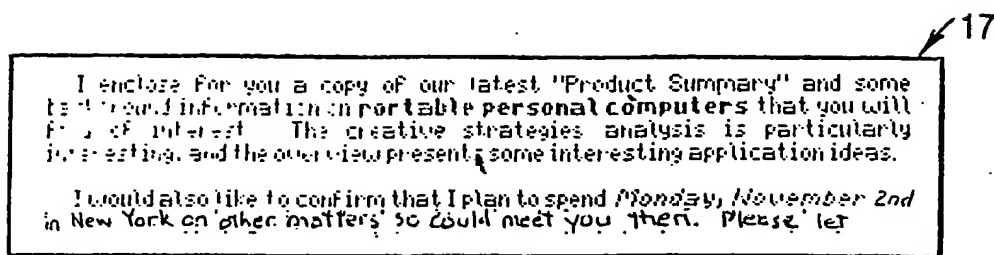


FIG. 4

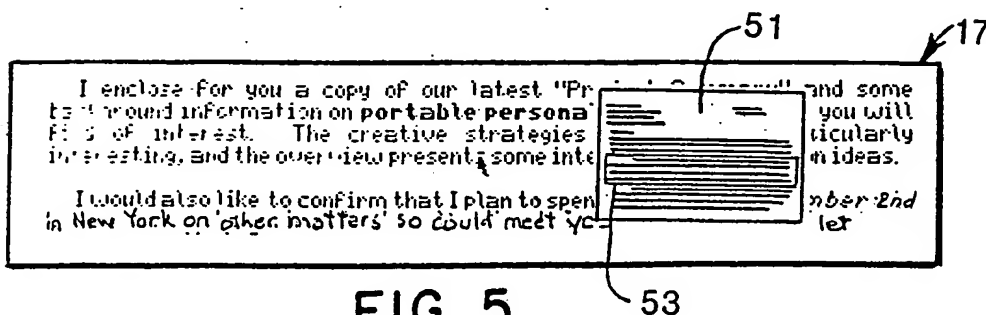


FIG. 5

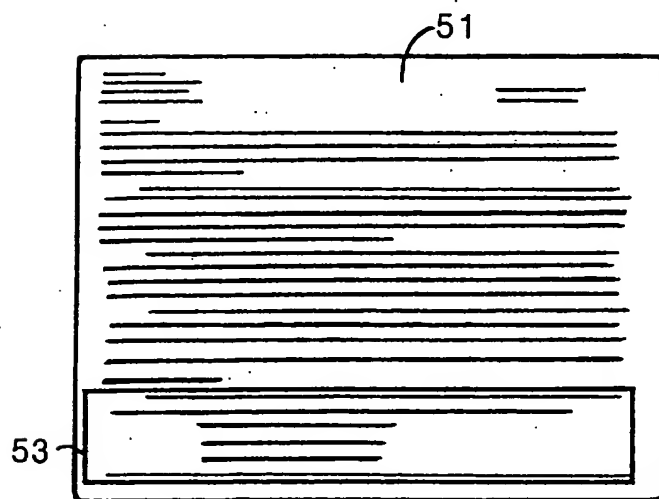


FIG. 6A

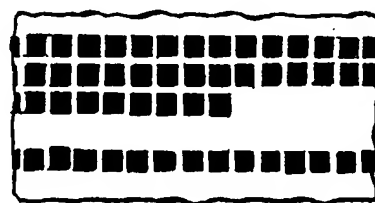


FIG. 6B

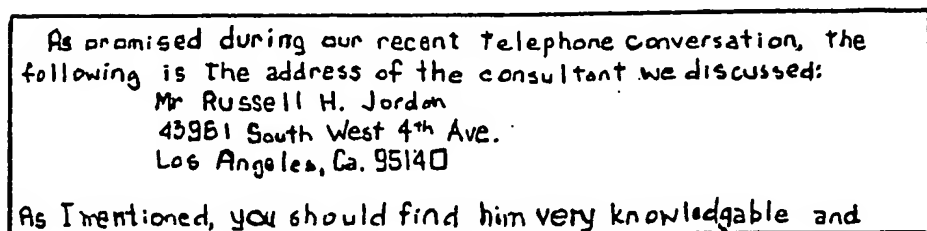


FIG. 7

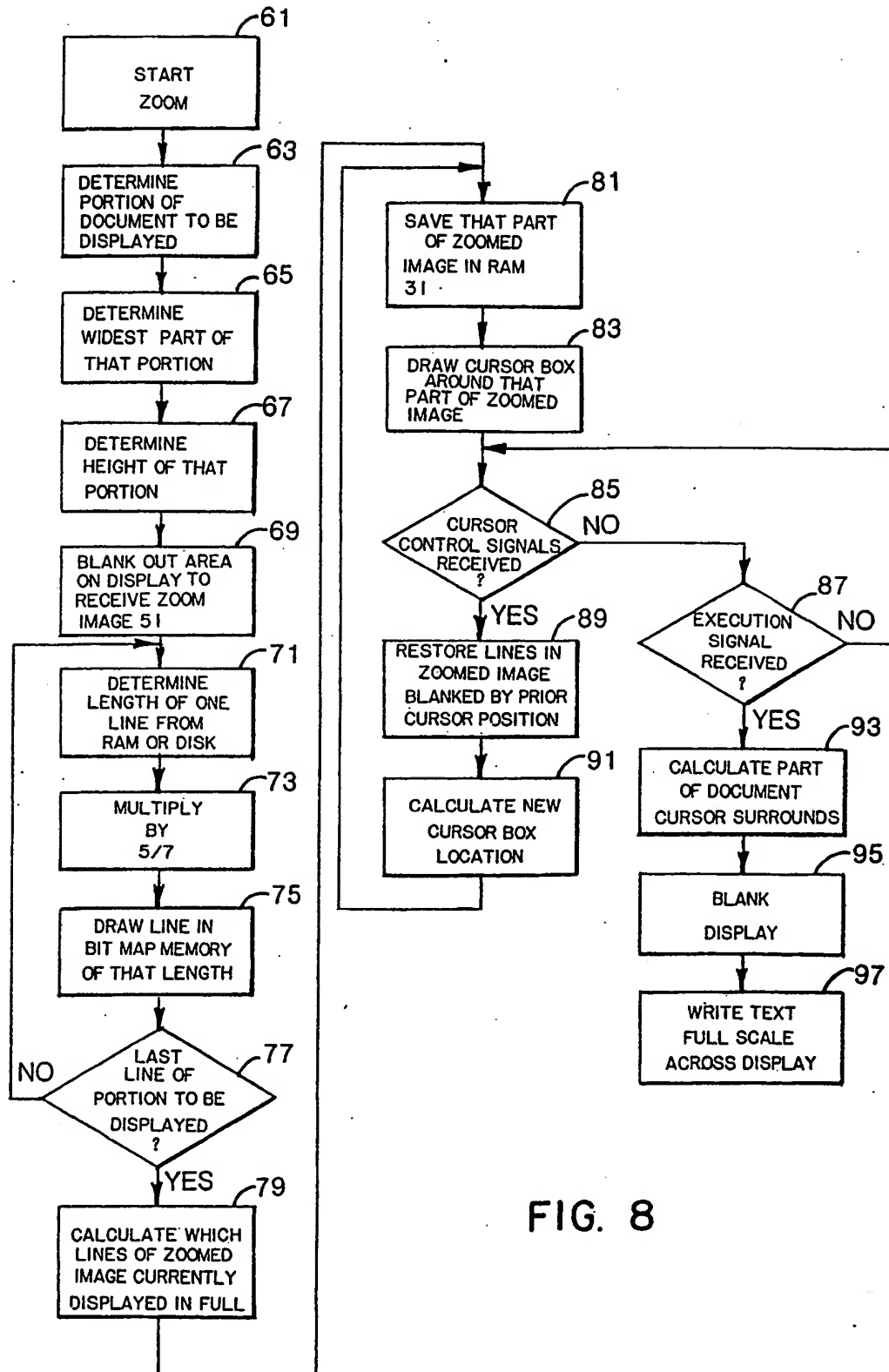


FIG. 8

SPECIFICATION

A Display System and a Method of Displaying Information

This invention relates to a display system and a method of displaying information. In particular, this invention relates to a system and method for displaying and manipulating information on a computer, especially for managing data files that are larger than can be displayed at one time on a display screen.

The most common technique for a computer user to keep track of a data file in the computer memory that is larger than can be displayed at one time on the computer display screen, is to scroll through the data file displaying successive parts of it on the screen. This capability is provided as a standard in word processing, data base management, graphics and other types of application computer programs.

When a small display screen is being used, such as found small battery operated portable computers, only a few lines and/or parts of lines of the memory data file can be displayed at one time. It is especially desirable in such circumstances to provide some system for the computer user to monitor portions of the document other than what can be displayed at one time, without having to scroll through the document.

According to a first aspect of the present invention, there is provided a display system, comprising means for displaying on a visual display means information in a form such that individual elements of the information are not visually identifiable and means for displaying a desired part of the information on the display means in a form in which the individual elements of the desired part are visually identifiable, in response to an instruction from a user.

Preferably, the means for displaying the information in a form in which the individual elements thereof are visually identifiable is arranged to display the information so that the overall shape and/or outline thereof is usually identifiable. Usually, the individual elements of the information comprises characters and/or symbols which are readable by a user when displayed so that each character and/or symbol is visually identifiable and, in a preferred arrangement, the characters and/or symbols are arranged to be displayed in data lines and the means for displaying the information in a form in which the characters and/or symbols are not usually identifiable is arranged to display a representation of the information in which individual data lines and their spatial relationship can be visually identified. Normally a user controllable cursor is provided on the display means to enable a selection of a desired part of the information when the information is displayed in a form in which the individual elements are not visually identifiable.

In a second aspect, the present invention provides a display system for allowing a user to

manage a document that is larger than can be displayed in readable form on a display, comprising: means responsive to electronic computer codes indicating the information contained in the document for displaying

representation of the information contained in the document which is unreadable by the user but which shows the shape and outline of information on the document; means responsive to a first input signal from a user for selecting a part of the information to be displayed in readable form by moving a cursor over the compressed display version to mark the said part; and means responsive to a second input signal from a user for displaying the selected part in a readable form.

In a third aspect the present invention provides a display system for a computer, comprising: memory means for electronically storing characters and symbols in lines to form a memory data file; a display means capable of normally displaying a maximum number of data lines less than the capacity of the memory means in readable form; means responsive to the memory means for displaying a representation of a number of data lines on the display means which is greater than the said maximum number of lines normally displayable, the representation showing the existence of lines and their spatial relationship without forming the characters and symbols in a readable form on the display; means responsive to control signals for displaying and moving a cursor across the displayed representation in order to mark a selected part of the information; and means responsive to control signals for causing the selected part to be displayed on the display means in a readable form.

Preferably the means for displaying the representation in arranged to display a plurality of lines that includes: a given number of data lines which number is displayable on the display means in a readable form, the given number of lines being marked with the cursor, and a number of data file lines occurring immediately before and/or after the given number of lines, and normally the cursor comprises a rectangularly shaped cursor which is movable to surround the selected part.

Generally the display means comprises a large number of equally shaped display elements that are individually activated by display signals to form a desired a two-dimensional array of a plurality of such display elements forming a readable character and/or symbol, the means for displaying information on the display means in a form in which individual elements in the form of characters and/or symbols are not visually identifiable being arranged to display a line of characters and in symbols by a display line which is only one display element in height, the number of display elements along the display line being proportional to the length of the line of characters and/or symbols when displayed so as to be readable.

Conveniently, the display system includes means for displaying information in which the

individual elements are not visually identifiable simultaneously with a selected part of the information in which the individual elements are visually identifiable.

- 5 The present invention also provides a computer whenever incorporating a display system in accordance with the first, second or third aspect of the invention.

- 10 In a further aspect, the present invention provides a computer having a display screen capable of displaying in readable form only a certain number of lines of alpha-numeric characters but allowing a user to monitor a document having significantly more lines stored in a memory by including means responsive to the information stored in the memory for simultaneously displaying on the screen the certain number of lines in readable form and a compressed unreadable representation of a much larger number of lines of the document including said certain number of lines being displayed.

- 20 The present invention also provides a method of displaying information, comprising displaying information on a visual display means in a form such that individual elements of the information are not visually identifiable and displaying a desired part of the information on the display means in a form in which the individual element are visually identifiable in response to an instruction from a user.

- 30 In another aspect the present invention provides a method of displaying information stored by electronic signals in a memory of a computer system on a display screen comprising the steps of: generating from the memory signals reduced scale image signals representing information stored in the memory greater than what can be displayed full scale on the screen; displaying the reduced scale image in response to the reduced scale image signals; moving a cursor on the display screen to mark a selected part of the reduced scale image that is desired to be displayed full scale; identifying the electronic signals stored in memory that are responsible for forming the selected part of the reduced scale image that is marked by the cursor on the display screen; and displaying the selected part in full scale on the display screen.

- 50 This display system embodying the invention thus enables display of a non-readable representation of a larger part of a document than can be displayed in a readable form on the computer display. When the document contains alpha-numeric characters and related symbols, such a display most simply indicates the existence of non-readable solid lines related to the length of the textual lines and having a very small height.

- 60 In a preferred embodiment, the display system provides a display cursor for marking the portion of the non-readable miniature representation that is presently or was last displayed in full readable form. A further advantageous feature is the ability to move the cursor on the non-readable representation to another portion of the document which, when directed by the user

giving the signal to do so, provides a full readable display of those document lines to which the cursor has been repositioned on the non-readable display.

- 70 For a better understanding of the invention and to show how the same may be put into effect, reference will now be made, by way of example, to the accompanying drawings; in which:

- Figure 1 shows, as an example, a portable computer incorporating a display system in accordance with the present invention;

- 75 Figure 2 is a general block diagram of the computer shown in Figure 1;

- 80 Figure 3A illustrates the formation of letters on the display of the computer of Figures 1 and 2, while Figure 3B shows a bit map memory pattern to generate a part of the display of Figure 3A;

- 85 Figure 4 shows an example of alpha-numeric information presented on the display of the computer of Figures 1 and 2;

- Figure 5 shows the display for Figure 4 with a non-readable outline of a larger part of the document displayed being superimposed thereover;

- 90 Figure 6A illustrates the superimposed non-readable document display of Figure 5 with its cursor moved to a different position, and Figure 6B shows an enlarged portion of the display of the pattern of Figure 6A;

- 95 Figure 7 shows a representative display of another portion of the document as selected by moving the cursor as illustrated in Figure 6A; and

- 100 Figure 8 is a flow chart showing the major operating steps executed by the computer to create the displays of Figures 4 to 7.

- Referring now to the drawings and a particular Figure 1, there is shown a portable computer incorporating a display system embodying the invention. It should be understood that the display system, although particularly advantageous in a portable computer or computer system having a small display screen, can be used in any computer or computer terminal having a display.

- 110 Referring to Figure 1, a case 11 contains an ordinary keyboard 13 along a front edge that is enclosed by a cover 15 when the unit is being transported. The cover 15 is shown in Figure 1 to be in an upright position and contains a display screen 17 of an appropriate type. The preferred type of display screen 17 is a liquid crystal display (LCD) because of its low power consumption. The display is of a pixel type and is capable of displaying a plurality, such as eight or more, lines of single spaced alpha-numeric information, or graphics of a similar size.

- 120 Immediately adjacent the keyboard 13 is a touch pad 19 which is divided into various areas. The largest area 21 is connected for controlling the movement of a cursor 53 (Figure 5) on the display screen 17 in response to the user's touch being moved across the surface. Adjacent the large area 21 are a plurality of discrete touch key areas for performing other functions when touched by the computer user.

Referring to Figure 2, a general system block diagram shows the electrical interconnection of the various components of the computer of Figure 1. A common system bus 25 interconnects a central processing unit (CPU) 27, a read only memory (ROM) 29, a random access memory (RAM) 31, a disk drive 33 and various input/output devices 35 such as the keyboard 13, touch pad 19 and various external peripheral devices that can be connected with the computer 11. A bit map memory 37 is also connected with the bus 25 for temporarily storing information being displayed on the display 17 through a display driver circuit 39. The computer system is powered by rechargeable batteries (not shown).

Referring to Figure 3A, a small corner area of a typical type of display 17 is shown in large scale. A two dimensional array of individually energizable pixels, a representative pixel being labelled as 41, make up the display. Each of the LCD pixels may be controlled by signals from the bit map memory 37 to be in its off transparent state, as is the representative pixel 41, or in its on opaque state, as shown by representative pixel 43. Most typically, such a display is driven to form various letters, numbers and symbols with each being 5 pixels (dots) wide by 7 high, as shown in the display portion of Figure 3A. Of course, the particular configuration in the formation of such characters and the spaces between them is under control of the electronics that drives the display 17 and can be varied for particular different applications.

As a specific example for a computer of the type shown in Figure 1, its small display screen 17 contains an array of 400 pixels wide by 64 high. This allows about 65 characters to be formed in a line across the width of the display 17 and about 8 such lines to be formed one under the other, when utilizing the 5 by 7 pixel character format.

As is standard, each of the characters or symbols to be displayed is recorded in the RAM 31 with a specific byte code for each character or symbol, preferably in the standard ASCII format. When a display frame has been configured from a number of such characters organized in the RAM 31, the ASCII codes are converted by a look-up table, preferably in software, to generate a plurality of bytes in a different format that are then recorded in the bit map memory 37 for a single display frame. The contents of a portion of the memory 37 is shown in Figure 3B for the displayed letters of Figure 3A. As can be seen from Figure 3B, the bytes of information stored in the memory 37 can be considered as oriented horizontally adjacent to one another to form the pattern of the characters or symbols to be displayed. The capacity of the memory 37 is preferably made large enough to drive a larger display, such as a standard CRT screen which can be connected externally to the computer 11.

In order to illustrate the zoom display feature of the present invention, it is assumed that the RAM 31 and/or disk 3 contains all the ASCII

codes for the characters and symbols of a particular document that contains more lines than can be shown at one time by the display 17. A full display of a few lines in the middle of the document is shown in Figure 4. As shown in Figure 5, a greatly reduced scale representation of the document is simultaneously formed on the screen. This zoomed image 51 of the document is formed on the display 17 in an area in which the display has been blanked. Alternatively, the screen could be blanked so that only the zoomed image 51 is displayed but the format shown in Figure 5 allows the user to continue to make reference to the current or most recently displayed portion of the document.

As can be seen from Figure 5, each line of the document is shown in the image 51 as a solid, non-readable line that is one pixel in height and has a length that is proportional to the length of the line. The cursor 53 is in the form of a rectangle and surrounds the lines of information that are presently being displayed in a readable form. This gives the computer user an overall picture of the document for which only a few lines are being displayed in a readable form. It is preferable that the display 51 show approximately an equal number of lines ahead of and after the portion of the document being displayed in full, but, of course, this may be varied to meet certain other specific objectives. Of course, if the user is viewing the very beginning or the very end of document, the image 51 will show a representation of more document lines either after or before the portion being viewed, respectively.

The cursor 53 is moveable by the user up or down within the display portion 51 under the control of the X—Y cursor control touch pad 21, keys dedicated to the cursor moving functions, or other standard devices and techniques used to move a cursor over a computer display screen. Figure 6A shows the display 51 with the cursor 53 having been moved downward toward the bottom of the portion of the document from what is shown in Figure 5. When the user believes that he or she has located a portion of the document desired to be viewed, an execution signal is given the computer system through either the keyboard 13 or the touch pad 21 which causes the portion of the document within new cursor 53 as shown in Figure 6A to be displayed in full, readable form, as shown in Figure 7. When the display of Figure 7 exists, the operator can once again go into the "zoom" mode by giving the proper input command through the keyboard 13 or the touch pad 19 and the process is repeated again.

Referring to Figure 6B, an enlarged representation of the portion 51 of the display 17 is given. Each of the representative lines of the document is shown by a line of continuously energized pixels, each such line being formed vertically immediately adjacent the other without any blank pixels therebetween. Of course, if the document itself has a space or blank line, there

will be a blank line of pixels within the display 51 corresponding to that blank line of the document.

Although the particular pixel display arrangement for the representative document display 51 as being described in detail is believed preferable because of its economy in space and symmetrical representation of the document, there are other specific non-readable representations, as are apparent from this description, which would be satisfactory. For example, each of the characters of the document to be displayed could be simply represented by a single pixel or dot, this technique having the advantage of simplicity in forming the reduced display 51 but not having the advantages of the specific example herein that are described above. Other possible variations of the specific techniques being described include representing multiple characters by a single dot or more than one row of characters by a single row of dots. Further, although solid lines have been shown in the zoom image, gaps can be provided, particularly where the text being represented is arranged in columns.

Referring to Figure 8, the process of operation of the computer system of Figures 1—3 to bring about the results illustrated in Figures 4—7 will now be described in more detail. The process of controlling data forming a document or other computer memory data file may be done by a dedicated, hard wired electronic circuit but it is certainly preferable to do so with a general purpose system under computer software control. Figure 8 illustrates the process of manipulating stored data and controlling the various computer elements that is particularly adapted to software control.

The first step illustrated by block 61 of Figure 8 is to initiate the process, and this is done by the operator, through the keyboard 13 or touch pad 19, when a screen of information such as that shown in Figure 4, is being displayed in full, readable form. The next step 63 is to determine the portion of the document or other data file stored in the RAM 31 or disk 33 whose representative, non-readable image is to be displayed in the small image 51. It is preferable to identify an equal number of lines immediately before and after the displayed portion but any other configuration can be alternatively selected depending upon the specific application. Since only one pixel line of the display screen 17 is utilized for each line of document information in the display 51, 40—60 lines of a document can be represented on that display for the particular size of screen discussed in this specific example. Whatever that particular number selected as part of the system design, that number of lines of the document are identified in memory for subsequent processing.

The next step 65 is to determine the widest part of that document portion. That is, the length of the longest line is determined. Next, a step 67 determines the height of that portion of the document. Obviously, if the document is not as large as the number of lines which can be

displayed in the zoomed image 51, or if the document has a large amount of blank space at one extreme of the portion to be displayed, then the display 51 need not be full size and can be drawn smaller. A next step 69 is to blank out of the display 17 an area large enough to receive the zoomed image which is about to be formed. That is, a portion of the textural material being displayed on the screen will be blanked out so the image 51 can be displayed in its place.

The next major step is to form the display the image 51. A step 71 determines the length of the top most line of the document portion previously identified for display. That line length is multiplied by 5/7 in step 73 in order to make the display symmetrical. It will be recalled that in the specific example being described, each character is formed to be 7 pixels high by 5 pixels wide, so the multiplication of each line length in number of characters in the memory by this factor will make the resulting display 51 properly proportioned. Of course, other character relative sizes would require a different multiplication factor and, if desired, step 73 can even be omitted. Whatever length of line is to be displayed as part of the zoom image 51, that length is drawn into the bit map memory 37 by a step 75. A decision is made in step 77 as to whether the line just drawn is the last line in that part of the document previously identified for display. If it is not, the process of steps 71—75 is repeated for each line until the last line has been drawn in the image 51.

After all the lines of the document are represented in the image 51, a step 79 calculates which of those lines represent the lines that are currently or were most previously displayed in full readable form. That part of the zoomed image is then stored in memory, as indicated by a step 81. The cursor box 53 is then drawn around that portion of the image, as indicated by the step 83. Because of the compact nature of the image 51, the top and bottom horizontal lines of the box 53 necessarily obliterate the document lines previously formed on those rows of pixels. That is primarily why that part of the zoomed image is stored in memory, in accordance with step 81, prior to drawing the cursor box. Once the cursor box has been formed, the image 51 as shown in Figure 5 is completely formed.

In step 85 of Figure 8, the software looks for a control signal from the user of the computer to move the cursor box 53 to a different location of the image 51. If in one cycle of the software no such signal is received, then processing moves to step 87 to interrogate whether an execution signal has been received from the computer user. Each of these signals will typically be communicated through the touch pad 21 or the keyboard 13 but could also be generated in some external device.

If in a step 85 it is determined that the user desire to move the cursor, the processing proceeds to step 89 by restoring the lines of the zoom image 51 that were written over by the horizontal lines of the cursor, as discussed above.

This is the image that was stored in step 81. The next step 91 is to calculate the new cursor box location in response to the signals received from the user. The process then returns to step 81 to save that part of the zoomed image about which the cursor box is to be drawn and the cursor box is so drawn in a repeat of step 83, and so forth.

Once the operator provides an execution signal and it is detected in step 87, the cursor will no longer be moved and a step 93 calculates that part of the document data file in memory that the cursor surrounds. This is followed by blanking the entire display, in a step 95, and then writing that portion of the document data file on the display 17, (a step 97). This gives a full, readable display of another 8 lines of the document as indicated in Figure 7. The zoom process is then terminated but it can be initiated once again by the operator should the new portion of the document display not be what was desired.

It should be understood that the above-described display system is suitable for use with any computer or similar device. In particular, the display system is particularly useful in word processing and related applications where lines of characters and/or symbols forming a document are shown in the reduced scale image as narrow uniform density lines.

CLAIMS

1. A display system, comprising means for displaying on a visual display means information in a form such that individual elements of the information are not visually identifiable and means for displaying a desired part of the information on the display means in a form in which the individual elements of the desired part are visually identifiable, in response to an instruction from a user.

2. A display system to Claim 1, wherein the means for displaying the information in a form in which the individual elements thereof are visually identifiable is arranged to display the information so that the overall shape and/or outline thereof is visually identifiable.

3. A display system according to claim 1 or 2, wherein the individual elements of the information comprise characters and/or symbols which are readable by a user when displayed so that each character and/or symbol is visually identifiable.

4. A display system according to Claim 3, wherein the characters and/or symbols are arranged to be displayed in data lines and the means for displaying the information in a form in which the characters and/or symbols are not visually identifiable is arranged to display a representation of the information in which individual data lines and their spatial relationship can be visually identified.

5. A display system according to claim 1, 2, 3 or 4, a the user controllable cursor is provided on the display means to enable selection of a desired part of the information when the information is

displayed in a form in which the individual elements are not visually identifiable.

6. A display system for allowing a user to manage a document that is larger than can be displayed in readable form on display, comprising means responsive to electronic computer codes indicating the information contained in the document for displaying a representation of the information which is unreadable by the user but which shows the shape and outline of information on the document; means responsive to a first input signal from a user for selecting a part of the information to be displayed in readable form by moving a cursor over the compressed display version to mark the said part; and means responsive to a second input signal from a user for displaying the selecting part in a readable form.

7. A display system for a computer, comprising: memory means for electronically storing characters and symbols in lines to form a memory data file; a display means capable of normally displaying a maximum number of data lines less than the capacity of the memory means in readable form; means responsive to the memory means for displaying a representation of a number of data lines on the display means which is greater than the said maximum number of lines normally displayable, the representation showing the existence of lines and their spatial relationship without forming the characters and symbols in a readable form on the display; means responsive to control signals for displaying and moving a cursor across the displayed representation in order to mark a selected part of the information; and means responsive to control signals for causing the selected part to be displayed on the display means in a readable form.

8. A display system according to Claim 7, wherein the means for displaying the representation is arranged to display a plurality of data lines that includes: a given number of data lines which number is displayable on the display means in a readable form, the given number of lines being marked with the cursor, and a number of data file lines occurring immediately before and after the given number of lines.

9. A display system according to Claim 7 or 8, wherein the cursor comprises a rectangularly shaped cursor which is movable to surround the selected part.

10. A display system according to any preceding claim, wherein the display means comprises a large number of equally shaped display elements that are individually activated by display signals to form a desired display, a two-dimensional array of a plurality of such display elements forming a readable character and/or symbol, the means for displaying information on the display means in a form in which individual elements in the form of characters and/or symbols are not visually identifiable being arranged to display a line of characters and/or symbols by a display line which is only one display element in

height, the number of display elements along the display line being proportional to the length of the line of characters and/or symbols when displayed so as to be readable.

- 5 11. A display system according to any preceding claim, including means for displaying information in which the individual elements are not visually identifiable simultaneously with a selected part of the information in which the individual elements are visually identifiable.

- 10 12. A display system substantially as hereinbefore described with reference to and as illustrated in, the accompanying drawings.

- 15 13. A computer whenever incorporating a display system in accordance with any one of claims 1 to 12.

- 20 14. A computer having a display screen capable of displaying in readable form only a certain number of lines of alpha-numeric characters but allowing a user to monitor a document having significantly more lines stored in a memory by including means responsive to the information stored in the memory for simultaneously displaying on the screen the certain number of lines in readable form and a compressed unreadable representation of a much larger number of lines of the document including said certain number of lines being displayed.

- 25 15. A computer substantially as hereinbefore described with reference to, and as illustrated in the accompanying drawings.

- 35 16. A method of displaying information, comprising displaying information on a visual display means in a form such that individual elements of the information are not visually identifiable and displaying a desired part of the information on the display means in a form in which the individual elements are visually identifiable, in response to an instruction from a user.

- 40 17. A method of displaying information stored by electronic signals in a memory of a computer system on a display screen, comprising the steps of: generating from the memory signals reduced scale image signals of a representing information stored in the memory greater than what can be displayed full scale on the screen; displaying the reduced scale image in response to the reduced scale image signals; moving a cursor on the display screen to mark a selected part of the reduced scale image that is desired to be displayed full scale; identifying the electronic signals stored in memory that are responsible for forming the selected part of the reduced scale image that is marked by the cursor on the display screen; and displaying the selected part in full scale on the display screen.

- 55 18. A method of displaying information substantially as hereinbefore described with reference to the accompanying drawings.

- 60 19. Any novel feature or combination of features described herein.